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Changing face of orofacial pain: The diagnostic impact of working with Neurology on an orofacial pain clinic

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Abstract

This study assessed the impact of collaborative working with a headache neurologist on diagnoses of patients attending orofacial pain (OFP) clinic. Patient diagnostic data was collected from adult patients attending an Orofacial Pain Service from January 2013 to January 2017. A liaison headache neurologist was appointed late 2015; OFP clinics were co-run with the neurologist specialist thereafter. Overall, 639 patients attended the service; 315 in 2013-2015 and 324 in 2016-2017. Compared to 2013-2015, there were increased rates of diagnoses related to neurovascular (27.5% vs. 19.0%; *P*= .012) and musculoskeletal pain (36.9% vs. 26.0%; *P*=.003) in the 2016-2017 cohort and decreased rates of neuropathic (55.6% vs 70.2%; *P*<.001) and atypical/idiopathic pain (1.3% vs. 5.4%; *P*=.003) diagnoses. There was a trend towards an increased rate of comorbid diagnoses (26.3% vs. 20.3%; *P*=.077), especially those relating to headache conditions. The findings suggest that introduction of a specialist headache neurologist into the OFP clinic widened its remit of assessment, increasing recognition of (co-morbid) neurovascular-related pain and decreasing atypical / idiopathic pain diagnoses in patients with complex OFP. The increase rate of musculoskeletal pain diagnosis in the later cohort is likely attributable to service expansion and normalisation of diagnostics reportedly seen in other OFP services.

Statement of Clinical relevance: Orofacial pain is a complex diagnosis, it requires a multidisciplinary approach that includes neurological input.

Key words: Orofacial pain, misdiagnosis, post traumatic neuropathic pain, temporomandibular disorder, idiopathic facial pain, headache, neurovascular.

Introduction

Misdiagnosis of orofacial pain and poor pain management are one of the most common causes of patient complaints related to dentistry (GDC forum data 2016) [1]. Dentists are familiar with odontogenic pain, however, non-odontogenic pain can mimic toothache leading to misdiagnosis and inappropriate management [2].

Orofacial pain OFP classifications are multiple and conflicting, they include; International Classification of Headache Disorders (ICHD-3β)[3] (which include headache or facial pain caused by disorders of the teeth in Chapter 11 and the other non-dental causes of OFP are included in Chapter 13) [3], the International Association for the Study of Pain (IASP) [4] classification (which has been modified to acknowledge peripheral and centralised driven pain), the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD)[5] and the American Academy of Orofacial pain[6]. The lack of a consensus in diagnostic criteria may lead to increased misdiagnosis of OFP [7].

The numerous causes of OFP reflect the complex anatomical boundaries involved and give rise to diagnostic and management challenges for OFP conditions, which require clinical input from multiple specialities. Multidisciplinary approaches to diagnosis and management of OFP has proven to be cost effective strategy for managing OFP and complex headache disorders [8]. The orofacial pain service at Kings College Hospital, London consults a high volume of OFP patients (>1000 per year) including follow-up visits. Initially, the OFP service relied entirely on dental specialities with referral to other specialities without direct liaison with neurology. By 2013, clinical psychology and liaison psychiatry were introduced to OFP service. Due to recognition of multiple medical and pain co-morbidities in patients seen on the OFP service in 2015, a liaison headache neurologist was appointed to the Multidisciplinary Team (MDT) to improve diagnostic process and management of a range of orofacial pain conditions. In addition to assessing patients with (possible) neurovascular

conditions, the neurologist facilitated staff training in headache clinical presentation through observations of the specialist assessing patients, MDT team discussions with neurology input, and an increased emphasis on identifying migraine-headache associated symptoms when assessing patients presenting with OFP. In this service evaluation study, we evaluated the impact on an existing OFP service of working with a specialist headache neurologist on OFP diagnosis.

Methods

The study sample included consecutive patients, aged 18 years and above, attending the OFP Clinic at King's College London Hospital from January 2013 to January 2017. The service from 2013 was run by a multidisciplinary pain team including; oral surgery, oral medicine, clinical psychology and liaison psychiatry, the only newly introduced member (neurology) was in early 2016. A need for neurological input was identified due to the medical complexity of multiple OFP diagnostics. This coincided with a newly appointed academic lead for neurology with headache interest to the main trust hospital in early 2016. In 2016 the service became established with increase referrals (from approximately 1800 to 2500 appointments per year), from other centres. The primary analyses compared the diagnoses given to patients attending the OFP Clinic at King's College London Hospital before and after the appointment of a headache Neurologist.

Clinical examination and diagnosis

Clinical examination of the patients was performed by trained clinicians in the OFP. A diagnosis or diagnoses (in the case of multiple conditions associated with orofacial pain) was/were made according to the International Headache Society Classification [(3)], the Research Diagnostic Criteria for Temporomandibular Disorders [(9)] and the International Association for the Study of pain [(10)]. The clinics were co-run with the neurologist specialist.

Initial assessment was conducted by the oral surgeon and depending on the outcome - if it was indicated that a patient required assessments by a neurologist - then this was asked for.

Data collection

For patients referred to the clinic from January 2013- December 2015, patients' case notes were retrospectively analysed. In addition to demographic data, relevant information about diagnosis and condition history (duration) was extrapolated from case notes. Data for patients referred to the clinic from January 2016 – January 2017 was collected prospectively and included demographic, diagnosis and condition history. Patients were recruited in accordance with approval by the local Trust Research and Development Committee. Ethical approval for the study was provided by the National Research Ethics Service Committee, London Dulwich (REC number 15/L0/1108). Informed consent was taken from the individual participants for their anonymized data to be used for research purposes.

Data Analysis

Descriptive data was presented in the form of mean, standard deviation (SD), absolute number and percentage (%). Comparisons of demographic variables between 2013-2015 and 2016-2017 cohorts were performed using independent group *t*-tests with bias-corrected and accelerated [2000 repetitions] bootstrapping methods employed where continuous distributions violated normality assumptions. Differential diagnosis rates, grouped together based on broad symptomatic classes (neuropathic, musculoskeletal, neurovascular and idiopathic [(11)]) were compared between cohorts using chi-square tests, with odds ratios (OR) and 95% confidence intervals (CIs) calculated. The level of significance was set at $P < 0{\cdot}05$. All statistical analyses were completed with the SPSS, version 24.

Results

Over the study period, 639 consecutive adult patients presenting with orofacial pain attended the clinic as a result of referrals from general practice or other specialist dental services; 315

in the 2013-2015 cohort and 324 in the 2016-2017 cohort. The majority of patients were female (464 or 73.0%) with no differences between groups (2013-2015 73.4%; 2016-2017 72.5%; $P = 0.806$). The mean age was a little under 50 years (Mean (M) = 48.17, SD = 14.26) and the age distribution was highly comparable between cohorts (2013-2015 M = 48.11, SD = 14.35; 2016-2017 M = 48.23, SD = 14.19; $P = 0.917$). The median duration of pain onset was 18.0 months (inter-quartile range (IQR) = 7.0-48.0) with 93.1% of patients reporting pain for 3 or more months at clinic appointment. Time since pain onset was similar in both cohorts (2013-2015 Median = 16.0, IQR = 7.0-36.0; 2016-2017 Median = 18.0, IQR = 7.0-48.0; $P = 0.577$).

Orofacial pain diagnoses

Data concerning patient diagnosis was examined for all cohort patients. Where patients in the 2016-2017 cohort had a provisional diagnosis only (17 or 5.2%), this was used. At the time of data collection, 4 (1.2%) patients in the 2016-2017 cohort had received neither a formal diagnosis nor a provisional diagnosis due to ongoing investigations – these patients were excluded from subsequent descriptive and comparative analyses. Almost 30% of 2016-2017 patients (92 of 320) with a diagnosis had been referred to specialist headache neurologists for examination after consultation with oral surgery staff members.

In total, 148 (23.3%) patients presented with multiple diagnoses. A fifth of (64 or 20.3%) patients in the 2013-2015 cohort had multiple diagnoses (2 diagnoses $n = 55$, 3 diagnoses $n = 9$). This increased to more than a quarter (84 or 26.3%) in the 2016 cohort (2 diagnoses $n = 69$, 3 diagnoses $n = 13$, 4 diagnoses $n = 2$), a difference that was marginally significant ($\chi^2 = 3.13$, $P = 0.077$).

Insert Table I about here

The frequencies (percentages) of diagnoses associated with patients' presenting orofacial pain for each cohort is displayed in Table 1. With respect to neuropathic pain conditions, there were decreases in the proportion of patients with painful post traumatic neuropathy (PPTN) and patients with spontaneous neuropathy. The most obvious change, however, was the emergence of the diagnosis of persistent dento-alveolar pain 2 (PDAP2) under PPTN. This was a reconciliation of problematic recommendations in classification guidance for PDAP where it emerged that persistent dento-alveolar pain 1 (PDAP1), considered under spontaneous neuropathy, was infrequently diagnosed in both cohorts; however PDAP 2 was considered synonymous with PPTN. The proportion of patients diagnosed with burning mouth syndrome (BMS) increased very slightly in the 2016-2017 cohort while a small number of cases of occipital neuralgia and geniculate neuralgia, absent in 2013-2015, were identified in the recent cohort.

The vast majority of TMD diagnoses were myofascial pain of the masticatory muscles or joint disc displacement (with or without reduction) and were observed more frequently in the 2016-2017 cohort of patients. Within neurovascular pain classifications, trigeminal autonomic cephalalgia (TAC) was diagnosed in a small number of cases only, although 10 patients did receive a diagnosis of hemicrania continua in the 2016-2017 cohort compared with none in the earlier cohort. However, the proportion of patients with head migraines (V1) and other primary or secondary headaches increased markedly from 2013-2015 to 2016-2017. A small number of patients were diagnosed with atypical facial pain / persistent idiopathic facial pain (PIFP); 4 patients in the early cohort were diagnosed with atypical odontalgia, a sub type of PIFP[3], but none received this diagnosis in 2016-2017 cohort.

Insert Table II about here

Formal comparisons between cohorts of differential diagnosis rates, grouped together broadly according to main symptomatic class, revealed several significant differences (Table 2). Diagnoses of neuropathic pain were less common in 2016-2017, decreasing from over 70% in 2013-2015 to under 60%. In contrast, the odds of diagnoses of TMD and of neurovascular-related conditions both increased by approximately 1.6 fold in the recent cohort. More specifically, the proportion of TAC and migraine diagnoses in the 2016-2017 cohort increased, although differences between cohorts were not significant (Table 2). When head migraines were considered separately (Table 1), there was a significant increase (7.9% in 2013-2015 to 13.1% in 2016-2017; $P = 0.033$), however. Most obviously, the odds of a diagnosis relating to other primary/secondary headache significantly increased by 2.5 times. Finally, there was a significant and marked decrease in the number of diagnoses associated with atypical/idiopathic pain given in 2016-2017 compared with 2013-2015.

Insert Table III about here

Analyses indicated significantly higher rates of diagnoses relating to neurovascular pain in the 2016-2017 cohort compared to the 2013-2015 cohort, and a trend in the recent cohort towards patients receiving multiple diagnoses more frequently. An examination of the patterns of diagnostic rates, considering comorbid diagnoses with different symptomatic classification, reflected a marginally significant increase in rates of comorbid neurovascular and neuropathic and/or musculoskeletal (TMD) pain diagnoses in the 2016-2017 cohort ($P =$

.080) rather than a change in comorbid neuropathic and TMD pain diagnoses, which decreased slightly (Table 3). Notably, within the 2016-2017 cohort, patients with a diagnosis of neurovascular pain were much more likely to be diagnosed with a comorbid orofacial pain condition with a different symptomatic classification (e.g., a comorbid neuropathic and/or musculoskeletal pain; 53/88 or 60.2%) than patients with a diagnosis related to neuropathic pain (31/178 or 17.4%) or a diagnosis of musculoskeletal (TMD) pain (49/118 or 41.5%).

Discussion

This study explored the impact of a headache neurologist in an OFP clinic, on diagnoses and treatment. Following the introduction of neurology input, we found an increase in the diagnoses of neurovascular/headache disorders, most obviously head migraine and other primary/secondary headaches, but also a trend for increased recognition of trigeminal autonomic cephalalgias (TACs). Furthermore, there was a tendency towards more comorbid (symptom classification) diagnoses, predominantly in cases where one or more headache conditions were identified. These changes cannot be explained by introduction of new clinical guidance, new diagnostic criteria or additional training (other than training in headache clinical presentation) of the core OFP service staff. Commissioning of the OFP service did not change, however service expansion was observed during the overall period, possibly explaining the increase in diagnoses of TMD and related conditions in the second cohort. The marked decrease in idiopathic diagnoses and increased neurovascular diagnoses, likely reflect additional neurological input in the second cohort, although direct causality is not claimed and differences in the distribution of clinical diagnoses may also relate to natural changes in patient presentation over time. We nevertheless suggest that OFP clinics co-run with the neurologist specialist, which facilitate joint clinic case discussions with feedback on the appropriateness of provisional diagnoses and taking more comprehensive headache history as part of routine clinical assessment (including asking questions on migraine-

associated and autonomic symptoms), enable clinicians to more often identify non-dental facial pain and reduce idiopathic diagnoses.

The significant decrease in the number of diagnoses of atypical/idiopathic facial pain given in 2016-2017 (compared with 2013-2015) to negligible levels represents a positive development. The diagnosis of atypical or persistent idiopathic orofacial pain (PIFP) is made after excluding all other possible known causes [12], frequently made after thorough investigation by several medical specialities and often result in inadequate treatments before PIFP is diagnosed[13] [14]. In the past PIFP or atypical facial pains were frequently referred to as being psychosomatic in origin [15-17], a label which can be distressing for a patient [18]. The pathophysiology of PIFP largely remains a mystery; and underlying neuropathic mechanism has been suggested although the aetiology needs further exploration [19]. Although the extent to which the decrease in atypical/idiopathic facial pain diagnoses in this study is directly attributable to improved recognition of primary headache disorders with facial pain radiation and/or the education received by clinicians whilst working with a headache trained neurologist is unclear, it likely reflects the benefits of adopting an MDT approach at the assessment stage.

The trend for increased trigeminal autonomic cephalalgias (TACs) diagnoses in the later cohort is important. TACs are a group of primary headache disorders characterized by unilateral head pain that occurs in association with generally prominent ipsilateral cranial autonomic features[20]. The pain related to TACs is unilateral, normally centered over the V1 territory. However, radiation of the pain in V2 and V3 is frequently reported, making the differential diagnosis with short-lasting paroxysmal OFP condition potentially challenging [21]. It is essential to distinguish between these conditions to optimize patient management.

The decrease in proportion of neuropathic pain diagnoses in the recent cohort and increase in proportion of TMD diagnoses is more difficult to explain and is unlikely to be

explained by additional neurological diagnostic input. This particular department specialises in post-traumatic neuropathy and has a higher proportion of these patients compared with most orofacial pain clinics. It is likely that due to expansion and development of the MDT OFP service more patients with TMD were referred to the service impacting on the proportions of the diagnostic range. In addition, TMDs with masseteric and temporalis pain can be referred to maxillary and mandibular molar teeth which may also complicate diagnosis [22].

The present study observed an increasing trend of comorbid OFP diagnoses from one (chronological-based) cohort to the other. Considering the high comorbid prevalence of headaches, this is also likely to be attributable, at least in part, to greater neurology input in the diagnostic pathway of the recent cohort. Although the presence of painful comorbidities can add to a confusing scenario, given their potential negative impact on disease progression and treatment resistance, the importance of classifying comorbid orofacial pain conditions cannot be understated [23] For example, while the findings here are consistent with both clinical and population-based studies reporting a high prevalence of primary headaches associated with TMD [24, 25], there is evidence that the presence of migraine is an important factor in both the duration and intensity of TMD pain [26]. As such, greater awareness of headache classification criteria content by OFP clinic staff, specifically enabled by direct liaison with a trained headache neurologist, can help staff to better identify possible comorbidities and ultimately increase chance of treatment success [27].

Strengths and limitations

The sample size in this study was large and represented all adult patients presenting with orofacial pain to national orofacial pain service within a four-year period. Additionally, the two timeframes under investigation are consecutive and yielded similar numbers of patients in each cohort that were comparable with regard to age, gender and time since pain

onset. There are a number of limitations, however. Firstly, the methods of data collection differed between cohorts, with retrospective extraction of data from case notes for the early cohort in contrast to the latter cohort where data was collected contemporaneously with patients' consultations, which may introduce some inconsistencies. Secondly, although, as noted previously, the patient pathway, dental clinical staff and diagnostic criteria were consistent over the study period (other than introduction of neurological input), the clinic did expand with additional capacity to see more referrals which most commonly are TMD conditions in OFP clinics [(28)]. Thirdly, it is difficult to say that if patients with neurovascular disorders in the first cohort (2013-2015) were ever referred directly to neurology, and if so, what the outcome was. If they were referred and the information on the outcome of the consultation was available, it may have resulted in less differences between the two cohorts. This needs investigation in future research. Fourthly, there was a significant proportion of diagnosed post traumatic neuropathic pain cases, likely due to the clinic lead having a specialist interest in this area. This may not reflect in other clinics involved in the care of patients presenting with OFP. Finally, although the number of formal comparison was small and almost all analyses yielding significant results did so with associated *P* values of less than 0.001, there was no correction for multiple comparisons, raising the risk of Type I errors.

Clinicians attending patients with orofacial pain conditions should ideally have additional training in headache disorders to ensure appropriate diagnoses are made. Neurological input on clinic joint case discussion and feedback on the appropriateness of the provisional diagnosis allows collegiate learning across specialties. The findings of this study suggest that increased input by staff trained in headache neurology on orofacial pain clinics is associated with a higher rate of primary headache diagnoses, including comorbid diagnoses, and a reduction in the number of diagnoses of exclusion, such as PIFP.

Introduction of neurological input to an OFP service is likely to educate a team that has not undergone explicit OFP postgraduate training. Although this is a precedent set in the US training programmes[29], it remains poorly established elsewhere. Indeed, specialist training in OFP does not yet exist in the UK [30] or mainly outside the USA. This study suggests a need for improved training of the dental workforce providing this OFP service and a need for a UK based post graduate training programme in OFP.

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Compliance with Ethical Standards

Conflict of Interest:
Author A (Aalia Karamat) declares that she has no conflict of interest. Author B (Jared. G. Smith) declares that he has no conflict of interest. Author C (Giorgio Lambru) declares that he has no conflict of interest. Author D (Tara Renton) declares that she has no conflict of interest.

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Ethical approval:
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Informed consent:
Informed consent was obtained from all individual participants included in the study.

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Table I. Diagnoses for patients presenting with orofacial pain in 2013-2015 and 2016-2017 cohorts.

	2013-2015 (*n* = 315)	2016-2017 (*n* = 320)
	***n* (%)**	***n* (%)**
Neuropathic		
Painful Post Traumatic Neuropathy	151 (47.9)	98 (30.6)
Persistent Dento-Alveolar Pain 2	0 (0.0)	29 (9.1)
Spontaneous Neuropathy	26 (8.3)	20 (6.3)
Persistent Dento-Alveolar Pain 1	4 (1.3)	2 (0.6)
Burning mouth syndrome	8 (2.5)	11 (3.4)
Trigeminal Neuralgia Classical	17 (5.4)	15 (4.7)
Trigeminal Neuralgia Non-classical	19 (6.0)	6 (1.9)
Occipital Neuralgia	0 (0.0)	8 (2.5)
Geniculate Neuralgia	0 (0.0)	1 (0.3)
Musculoskeletal (Temporomandibular Disorders)		
TMJ Myofascial Pain of the Masticatory muscles	52 (16.5)	66 (20.6)
TMJ Arthritis/Arthalgia	3 (1.0)	3 (0.9)
TMJ Disc Displacement with/without reduction	26 (8.3)	45 (14.1)
TMJ Mixed (Muscular and Joint diseases)	1 (0.3)	4 (1.3)
Neurovascular (Headache disorders)		
Trigeminal Autonomic Cephalalgia		
Unspecified	3 (1.0)	2 (0.6)
Cluster Headaches	0 (0.0)	1 (0.3)
SUNCT	3 (1.0)	4 (1.3)
SUNA	1 (0.3)	0 (0.0)
Paroxysmal Hemicrania	2 (0.6)	2 (0.6)
Hemicrania Continua	0 (0.0)	9 (2.8)
Migraine		
Head Migraine	25 (7.9)	42 (13.1)
Facial Migraine	12 (3.8)	7 (2.2)
Other Primary/Secondary Headaches	17 (5.4)	40 (12.5)
Atypical/Idiopathic		
Persistent Idiopathic Facial Pain	13 (4.1)	5 (1.6)
Atypical Odontalgia	4 (1.3)	0 (0.0)
Neurological		
Facial Dystonia	1 (0.3)	0 (0.0)

Notes: Diagnoses are not mutually exclusive across patients (64 and 84 patients had received more than one diagnosis in the 2013-2015 and 2016 cohorts, respectively) - as such, percentages in each column do not add up to 100%; TMJ = Temporomandibular Joint and Muscle Disorders; SUNCT = Short-Lasting Unilateral Neuralgiform Headache Attacks with Conjunctival Injection and Tearing; SUNA = Short-Lasting Unilateral Neuralgiform Headache Attacks with Cranial Autonomic Symptoms; Other Primary/Secondary Headaches includes tension-type headaches.

Table II. Comparison of diagnostic classifications for patients in 2013-2015 and 2016-2017 cohorts according to broad symptomatic class.

	2013-2015 (*n* = 315)	2016-2017 (*n* = 320)			
	n (%)	*n* (%)	χ^2	OR (95% CI)	*P*
Symptomatic Class					
Neuropathic	**221 (70.2)**	**178 (55.6)**	**14.36**	**0.53 (0.38,0.74)**	**<0.001**
Musculoskeletal (Temporomandibular Disorders)	**82 (26.0)**	**118 (36.9)**	**8.65**	**1.66 (1.18,2.33)**	**0.003**
Neurovascular (Headache Disorders)	**60 (19.0)**	**88 (27.5)**	**6.35**	**1.61 (1.11,2.34)**	**0.012**
Trigeminal Autonomic Cephalalgia	9 (2.9)	18 (5.6)	2.99	2.03 (0.90,4.58)	0.084
Migraine	37 (11.7)	46 (14.4)	0.97	1.26 (0.79,2.01)	0.326
Other Primary/Secondary headaches	**17 (5.4)**	**40 (12.5)**	**9.80**	**2.50 (1.39,4.52)**	**0.002**
Atypical/Idiopathic Pain	**17 (5.4)**	**4 (1.3)**	**8.54**	**0.22 (0.07,0.67)**	**0.003**

Notes: Classifications under symptomatic class headings are not mutually exclusive across patients (64 and 84 patients had received more than one diagnosis in the 2013-2015 and 2016 cohorts, respectively) - as such, percentages in each column do not add up to 100%; Chi-square tests were administered for comparisons; OR = odds ratio, CI = confidence interval; All significant group differences are highlighted in bold.

Table III. Patterns of diagnostic classifications for patients presenting with orofacial pain in 2013-2015 and 2016-2017 cohorts according to comorbidity and aetiology of condition.

	2013-2015 (*n* = 303)	2016-2017 (*n* = 315)
Diagnostic Classification	***n* (%)**	***n* (%)**
Neuropathic Only	187 (61.7)	147 (46.7)
Musculoskeletal (TMD) Only	37 (12.2)	69 (21.9)
Neurovascular Only	24 (7.9)	35 (11.1)
Neuropathic + Musculoskeletal (TMD)	19 (6.3)	11 (3.5)
Neuropathic + Neurovascular	10 (3.3)	15 (4.8)
Musculoskeletal (TMD) + Neurovascular	21 (6.9)	33 (10.5)
Neuropathic + TMD + Neurovascular	5 (1.7)	5 (1.6)

Notes: Diagnoses under the 'Atypical/Idiopathic' classification were not considered; patients with a sole diagnosis under the 'Atypical/Idiopathic' classification (e.g., persistent idiopathic facial pain) were excluded from the table and comparative analysis (2013-2015 $n = 12$; 2016 $n = 5$); A 2 (Group) x 7 (Diagnostic Classification) chi-squared test revealed a significant difference in proportions in each classification according to cohort ($\chi^2 = 22.08$, $P = 0.001$); TMD = temporomandibular joint disorder.